REMARKS

The comments of the Applicant below are each preceded by related comments of the Examiner (in small, bold type).

Takamura et al. discloses an apparatus comprising:

droplet ejection device (FIG. 2) comprising an element (FIG. 2, element 57) to change a volume of a fluid chamber (FIG. 2, element 63) of one of the droplet ejection devices, the element having an electrical capacitance (FIG. 2, element 53, each droplet ejection device being associated with a plurality of charging resistors (Abstract and FIG. 11, elements 92-93: The resistors are impedances of transistors 92-93); and

wherein for each droplet ejection device, a control circuitry provides the respective charge voltage or charge current by selecting a first charging resistor associated with the droplet ejection device to charge an electrical capacitance (FIG. 11, element 91) at a first rate followed by selecting a second charging resistor associated with the droplet ejection device to charge the electrical capacitance at a second rate before discharging the electrical capacitance (FIGs. 11, 12d, and 12j The charging resistors (impedance of elements 92 and 93) is selected to change the charge rate shown in FIGs. 12d and 12J), wherein the volume changing element comprises an electrically actuated displacement device (FIG. 2, element 57).

Takamura et al. however does not teach wherein the apparatus comprising at least two different ones of the droplet ejection devices and the control circuitry to effect uniform velocities of droplets elected from the at least two different ones of the droplet ejection devices by providing respective charge/discharge voltages or charge/discharge currents to the volume changing elements to individually control a charge on each volume changing element, wherein the control circuitry comprises charging/discharging control switches to connect or disconnect charge/discharge voltages or charge/discharge currents to respective elements to discharge the respective electrical capacitances.

Sakata et al. discloses an ink jet printer comprising a plurality of droplet ejection devices (FIGs. 6a-b) and a control circuitry to effect uniform velocities of droplets elected from at least two different ones of the plurality of droplet ejection devices by providing respective charge/discharge voltages or charge/discharge currents to the volume changing elements (FIGs. 6a-b, elements la-b) to individually control a charge on each volume changing element (Abstract and FIG. 8a-b, 15a-b), wherein the control circuitry comprises charging/discharging control switches to connect or disconnect charge/discharge voltages or charge/discharge currents to respective elements to discharge the respective electrical capacitances (FIG. 3, elements Tr1- Tr2).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to modify Takamura's printer to include a plurality of droplet ejection devices and individually control each of the plurality of droplet ejection devices in a manner as disclosed by Sakata et al. The motivation for doing so would have been to increase printing throughput by using a plurality of the droplet ejection devices and to suppress the variation in ejection speed of the ink droplets ejected from the plurality of the droplet ejection devices to ensure printing quality as taught by Sakata et al. (Abstract).

Claim 53

Takamura and Sakata do not describe and would not have suggested "for each droplet ejection device, the control circuitry provides the respective charge voltage or charge current by selecting a first charging resistor associated with the droplet ejection device to charge the electrical capacitance at a first rate followed by selecting a second charging resistor associated with the droplet ejection device to charge the electrical capacitance at a second rate to increase the volume of the fluid chamber before discharging the electrical capacitance to decrease the volume of the fluid chamber," as recited in claim 53.

The Examiner contends that the impedances of transistors 92 and 93 of FIG. 11 of Takamura correspond to the first and second charging resistors of claim 53. Applicant disagrees. In FIG. 11 of Takamura, the transistors 92 and 93 are used to charge a liquid crystal cell, represented by a capacitive element 91. Takamura does not disclose or suggest using the transistors 92 and 93 to charge an electrical capacitance of an element that changes a volume of a fluid chamber of a droplet ejection device. While Takamura discloses a piezoelectric element 57 of an ink jet head in FIG. 2, Takamura does not disclose or suggest using the two transistors 92 and 93 of FIG. 11 to charge the piezoelectric element 57 of FIG. 2.

A person of ordinary skill in the art would not have applied Sakata's technique of varying charge pulse signal width to the circuit shown in FIG. 11 of Takamura. The capacitive element 91 of FIG. 11 of Takamura is a liquid crystal cell. Takamura and Sakata do not disclose or suggest that different liquid crystal cells have different characteristics and need to be driven differently. The driving voltage V0 stored in the liquid crystal cell 91 determines the gray level shown by the liquid crystal cell 91. If the charge pulse signal width is varied such that the voltage stored in the liquid crystal cell 91 is different from the driving voltage V0, then the gray level shown by the liquid crystal cell 91 may be different from the intended gray level.

MPEP 2143.03 states: To establish prima facie obviousness of a clamed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180

USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 f.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Because Takamura and Sakata do not disclose or suggest all of the limitations of claim 53, claim 53 would not have been made obvious by Takamura and Sakata.

Even if a person of ordinary skill in the art were to replace the liquid crystal cell 91 in FIG. 11 of Takamura with the piezoelectric element 57 of FIG. 2, the person of ordinary skill in the art would still not have applied the technique of varying driving pulse width, as disclosed in Sakata, to the driving circuit of FIG. 11 of Takamura.

In Sakata, a pulse driver 13 outputs a voltage that rises in a linear manner (col. 5, line 67 to col. 6, line 1), and a transistor Q1 determines whether the pulse driver 13 output voltage is applied to the piezoelectric element 1a, thereby determining whether the piezoelectric element 1a is charged to Vmin, Vmax, or a voltage between Vmin and Vmax (FIG. 8a).

The person of ordinary skill in the art, after reading Takamura and Sakata, may have used the pulse driver 13 of Sakata to replace the driving voltage V0 in the Takamura circuit, and control the pulse widths of signals S11 and S12 to adjust the voltage stored in the capacitive element 91 in a range from Vmin to Vmax. However, in that case, there would be no need to use two PMOS transistors 92 and 93. The voltage applied to the capacitive element 91 follows the output voltage of the pulse driver 13, so one PMOS transistor would be sufficient. Regardless of using one or two PMOS transistors (92 and/or 93), the capacitive element 91 would be charged at a single rate determined by the pulse driver 13, which is different from what is recited in claim 53.

MPEP 2142 "Legal Concept of Prima Facie Obviousness" states that impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art. MPEP 2143.02 "Reasonable Expectation of Success is Required" states that a reasonable expectation of success of modifying the prior art is required to support a prima facie obviousness rejection.

Applicant notes that in the case of Takamura and Sakata, without using hindsight, there is no reasonable expectation that Takamura can be modified according to the teaching of Sakata to allow an inkjet head to effect uniform velocities of droplets ejected from at least two different ones of the droplet ejection devices, in which for each droplet ejection device, the control circuitry provides the respective charge voltage or charge current by selecting a first charging resistor associated with the droplet ejection device to charge the electrical capacitance at a first rate followed by selecting a second charging resistor associated with the droplet ejection device to charge the electrical capacitance at a second rate to increase the volume of the fluid chamber before discharging the electrical capacitance to decrease the volume of the fluid chamber, as recited in claim 53.

For the reasons set forth above, claim 53 is patentable over Takamura and Sakata.

Claim 74 is patentable over Takamura and Sakata for at least similar reasons as those applied to claim 53.

> **Chang et al. discloses an apparatus comprising:**
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> **droplet ejection devices comprising an element (FIG. 1, element 7) to change a volume of a fluid chamber (FIG. 1, element 1) of one of the droplet ejection devices, the element having an electrical capacitance (FIG. 12, element 65), each droplet ejection device being associated with a plurality of charging resistors (FIG. 12, elements 64, 74); and**
>
> **wherein for each droplet ejection device, a control circuitry provides a charge voltage or charge current by selecting a first charging resistor to charge the electrical capacitance associated with the droplet ejection device at a first rate (FIG. 13: V1) followed by selecting a second charging resistor associated with the droplet ejection device to charge the electrical capacitance at a second rate (FIG. 13: V2) before discharging the electrical capacitance (FIG. 12- 13: The resistor 64 or 74 is selected to charge the capacitance 65 during period T0-T1 and period T1 - T2).**
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> **Taki et al. does not teach wherein the apparatus comprising at least two different ones of the droplet ejection devices and the control circuitry to effect uniform velocities of droplets elected from the at least two different ones of the droplet ejection devices by providing respective charge/discharge voltages or charge/discharge currents to the volume changing elements to individually control a charge on each volume changing element, wherein the control circuitry comprises charging/discharging control switches to connect or disconnect charge/discharge voltages or charge/discharge currents to respective elements to discharge the respective electrical capacitances.**
>
> **Sakata et al. discloses an ink jet printer comprising a plurality of droplet ejection devices (FIGs. 6a-b) and a control circuitry to effect uniform velocities of droplets elected from at least two different ones of the plurality of droplet ejection devices by providing respective charge/discharge**

voltages or charge/discharge currents to the volume changing elements (FIGs. 6a-b, elements la-b) to individually control a charge on each volume changing element (Abstract and FIG. 8a-b, 15a-b), wherein the control circuitry comprises charging/discharging control switches to connect or disconnect charge/discharge voltages or charge/discharge currents to respective elements to discharge the respective electrical capacitances (FIG. 3, elements Tr1- Tr2).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to modify Chang's printer to individually control each of the plurality of droplet ejection devices in a manner as disclosed by Sakata et al. The motivation for doing so would have been to be able to suppress the variation in ejection speed of the ink droplets ejected from the plurality of the droplet ejection devices to ensure printing quality as taught by Sakata et al. (Abstract).

Claim 53

Chang and Sakata do not describe and would not have suggested for each droplet ejection device, the control circuitry provides the respective charge voltage or charge current by selecting a first charging resistor associated with the droplet ejection device to charge the electrical capacitance at a first rate followed by selecting a second charging resistor associated with the droplet ejection device to charge the electrical capacitance at a second rate to increase the volume of the fluid chamber before discharging the electrical capacitance to decrease the volume of the fluid chamber, as recited in claim 53.

Chang discloses applying a timing signal to a terminal 60 to turn on a transistor 61 and thereby turn on a transistor 62 to charge a capacitor 65, and using a one-shot multivibrator 70 to turn on a transistor 71 and thereby turn on transistor 72 to charge the capacitor. In the example of FIG. 12 of Chang, when a timing signal is output, a pressure generation chamber 1 contracts to generate an ink droplet and thus form a dot (col. 7, lines 12-20). Thus, in Chang, turning on the transistors 62 and 72 to charge the capacitor 65 causes the volume of chamber 1 to decrease, which is opposite of what is recited in claim 53.

What is missing in Chang is also not disclosed or suggested in Sakata, which discloses using a pulse driver 13 to outputs a voltage that rises in a linear manner (col. 5, line 67 to col. 6, line 1), and a transistor Q1 that determines whether the pulse driver 13 output voltage is applied to the piezoelectric element 1a, thereby determining whether the piezoelectric element 1a is charged to Vmin, Vmax, or a voltage between Vmin and Vmax (FIG. 8a).

Therefore, claim 53 would not have been made obvious by Chang and Sakata.

Claim 74 is patentable over Chang and Sakata for at least similar reasons as those applied to claim 53.

New claim 81

Takamura and Sakata do not describe and would not have suggested an array of charging resistors, each droplet ejection device being associated with a plurality of the charging resistors, and an array of charging control switches to connect or disconnect charge voltages or charge currents to respective elements through respective charging resistors to charge the respective electrical capacitances, as recited in claim 81.

Takamura discloses a high-impedance PMOS transistor 91 and a low-impedance PMOS transistor 92 (FIG. 11 and paragraph [0121]). Takamura does not disclose or suggest an array of charging resistors and an array of charging control switches, in which the array of charging control switches is distinct from the array of charging resistors.

What is missing in Takamura is also not disclosed or suggested in Sakata. Sakata discloses controlling switches Q1 and Q2 to connect or disconnect piezoelectric elements 1a and 1b, respectively, to a pulse driver 13. Sakata does not disclose or suggest an array of charging resistors and an array of charging control switches, in which the array of charging control switches is distinct from the array of charging resistors.

All of the dependent claims are patentable for at least the reasons for which the claims on which they depend are patentable.

Canceled claims have been canceled without prejudice or disclaimer.

Any circumstance in which the applicant has addressed certain comments of the examiner does not mean that the applicant concedes other comments of the examiner. Any circumstance in which the applicant has made arguments for the patentability of some claims does not mean that there are not other good reasons for patentability of those claims and other claims. Any

circumstance in which the applicant has amended or canceled a claim does not mean that the applicant concedes any of the examiner's positions with respect to that claim or other claims.

Please apply $312 for the excess claim fee and any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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